REMARKS/ARGUMENTS

The Examiner says that the restriction requirement is being maintained on the basis that not all claims contain the same technical feature. The Examiner alleges that claim 2 reciting 60% limonene does not contain the same technical feature as claim 1 because limonene is not a monoterpene with three degrees of unsaturation. The Examiner also alleges that Carnallite recited in some dependent claims is the specific formulation $KMgCl_36(H_2O)$ and does not include the sales of claim 1. Traverse is maintained.

The Examiner has not provide any support for the allegation that limonene is not a monoterpene with three degrees of unsaturation. As disclosed in the specification limonene has two double bonds and one ring and therefore is a monoterpene with three degrees of unsaturation (see specification at (p.6 penultimate paragraph)). Further, because claim 2 depends from claim 1, it incorporates from claim 1 the requirement of at least 70% monoterpenes. The balance (i.e., 70% monoterpene less the 60% limonene required by claim 2) can be made up by additional limonene or another monoterpene.

The Examiner also has not provided any support for the allegation that Carnallite has the specific formula $KMgCl_36(H_2O)$. Applicants attach an article indicating that in fact Carnalitte contains KCl, MgCl2 and NaCl. Thus, Carnalitte does include the salts recited in claim 1.

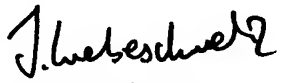
For these reasons, it is maintained that all claims share the same special technical feature, (i.e., an active agent containing at least 70% by weight monoterpenes with three unsaturations as in combination with a suitable carrier) and the restriction requirement should be withdrawn. It is further noted that even were the Examiner correct in the allegation regarding limonene and Carnalitte (which is denied), this would not provide a basis for restricting claims not reciting either of these elements.

In response to the species election, applicants elect at least 70% monoterpenes with three degrees of unsaturation as the active agent and $MgCl_2$ as the salt. The species election is traversed on the basis that the species proposed by the Examiner are not mutually exclusive as required by MPEP § 806.04(h). For example, "monoterpenes with three degrees of unsaturation"

is related to a "single type of extract," "type of oil," "at least 60% limonene" as genus and species rather than mutually exclusive species. Likewise, a compositions comprising $MgCl_2$, and a composition comprising a mixture of $MgCl_2$ and NaCl are related as genus and species (because of the open transition "comprising"), not as distinct species. Thus, the Examiner is effectively separating generic claims from their species, rather than separating one distinct species for another.

If the Examiner believes a telephone conference would expedite prosecution of this application, please telephone the undersigned at 650-326-2400.

Respectfully submitted,



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HOME

Dead Sea Works

DEAD SEA WORKS LTD

Industrial Activity at the Dead Sea / Aryeh Bodenheimer, Tuvia Zisner

The Dead Sea, rich in readily available minerals, is Israel's greatest natural resourc Situated at the lowest place on earth, it lies in a valley whose southern part is suitable f evaporation pans, and enjoys ample sunlight for most of the year. This combination chemical riches with topography amenable to practical use fired the imagination of Mosl Novomeysky, a Jewish chemical engineer from Siberia who came to Palestine at tl beginning of the century. Convinced of its potential he undertook an exhausting a frustrating struggle with the British Mandatory authorities and various others, and in 19 succeeded in obtaining a concession to extract minerals from the Dead Sea and establish the Palestine Potash Company Ltd. Novomeysky constructed his plant in the northern p of the Dead Sea, and in 1934 sent a group to Sodom in the south in order to constr evaporation pans and a chemical plant there. This became the foundation for today's De Sea Works.

Table 1. Composition of Dead Sea Water

Component	gr/Kg
NaCl	74.5
KCl	12.3
$MgCl_2$	147.7
$CaCl_2$	40.3
Br-	4.5
SO_4- -	0.3
Specific gravity 1.231	

RAW MATERIAL

Dead Sea water is pumped into a series of solar evaporation pans (ponds). The small amount of sulphate precipitates at the beginning of the evaporation process in the form of CaSO4. This leaves us with the comparatively simple system: NaCl-KCl-CaCl2-MgCl2-H2(The phase diagram of this system shows that evaporation of water will first precipitate NaC and further evaporation will precipitate the double salt carnallite, KCl·MgCl2·6H2O , togeth with NaCl. Accordingly, the Dead Sea Works have constructed 'salt pans' over an area of 105 km2 for the first-stage evaporation, and 'carnallite pans' over an area of 40 km2 for the second-stage evaporation yielding the raw material for the processes: 'carnallitite' KCl·MgCl2·6H2O+NaCl. The residual brine contains about 11-12 g/l bromide and is used f the production of bromine. Most of the residual brine is returned to the Dead Sea.

PROCESSES AND PRODUCTS

Carnallite
(KCl·MgCl2·6H2O+NaCl) is slurrified with the brine and pumped from the pans to the refineries by floating dredges, and is then filtered. This raw material is used for production

the following: potash, salt, magnesium chloride, magnesium oxide, hydrocloric acid, bath salts, chlorine, caustic soda and magnesium metal.

Potash
The first stage consists of the addition of water to dissolve the magnesium chloride. If the carnallite contains only a small amount of salt, the solid residue will be potash. This is calle cold crystallization. However, if a large amount of salt is present, the resulting solid will be mixture of salt and potash called sylvinite. This is refined by the hot crystallization process, based on the fact that the solubility of potash varies greatly with increasing temperature, while that of salt remains constant. Potash is leached from the sylvinite with a hot brine, th salt is filtered off, and the brine is cooled under controlled conditions to yield potash crystal Each year 2.7 million tons of potash are produced by the two processes.

Salt
The salt produced as by-product of hot leach crystallization is purified in the salt refinery, and marketed in different grades for various purposes. About half a million tons are sold each year.

Chlorine and Bromine
Salt solution undergoes electrolysis to yield chlorine, caustic soda and hydrogen. The chlorine is reacted with the residual brine from the pans to produce bromine. The caustic soda is sold, and the hydrogen is used to make bromine compounds, excess being burnt a fuel. The bromine is distilled from the brine and sold; partly as elemental bromine, and part in the form of bromine compounds produced in a plant at Ramat Hovav (near Beer Sheva) This is the largest bromine plant in the world, and Israel is the main exporter of bromine to Europe. About 200,000 tons of bromine are produced each year.

Magnesium Chloride
The residual magnesium chloride-rich solution is concentrated and sold as flakes for use ir the chemical industry and for de-icing (about 100,000 tons per year) and dirt road dedusting.Part of the solution is sold to the nearby Dead Sea Periclase plant (a subsidiary Israel Chemicals Ltd). At this plant the brine is decomposed thermally to give an extremely pure magnesium oxide (periclase) and hydrochloric acid.

Bath Salts
Partly dried carnallite contains the main components of the Dead Sea: magnesium chloride potash, salt, bromide, rubidium and a small amount of calcium chloride. Sold as bath salts, enables people to obtain some of the beneficial effects of the Dead Sea while bathing at home.

Magnesium Metal
A joint venture, Dead Sea Magnesium, has been undertaken between the Dead Sea Work (65%) and Volkswagen AG of Germany (35%) to produce and market magnesium from the carnallite harvested in the evaporation pans. Carnallite (containing magnesium chloride, potash and some salt) is dehydrated, melted and electrolyzed to yield magnesium metal ar chlorine. The residual salt and potash are sent to the potash plant for refining. Production began in 1997. About 25,000 tons of magnesium were produced in 1998, and sold as pure metal and alloys. Expansion of the plant is underway. A Magnesium Research Institute (MRI) has been set up in Beer-Sheva, with the participation of DSM and Ben Gurion University.

Aluminum Chloride
(anhydrous) Some of the chlorine produced in the plant is used to make anhydrous aluminum chloride by direct reaction with aluminum metal. It is used as a catalyst for orgar syntheses in other plants.

ECOLOGY AND QUALITY OF THE ENVIRONMENT

The Dead Sea Works are one of the largest utilizers of solar energy in the world. The use o the sun's rays to evaporate the brines in the pans saves burning of about 10 million tons of fossil fuels. However, the combination of a large-scale industrial complex with the unique ecology of the Dead Sea valley is very complicated. The Dead Sea Works have devoted time, effort and large funds to this problem, and a Chief Environmental Officer has been appointed to advise and supervise these activities, and to maintain contact with relevant statutory bodies. Several aspects of this subject include:

- Prevention of pollution by treatment of solid , liquid and gaseons wastes.
- Wadi gravel from the area is required for maintenance of the dikes and the pans. Care is taken to minimize the damage to these wadis.
- Process water requirements of the plants are about 25 million tons per year. Brackish water is pumped from aquifers at depths down to 700 m. However, not all these aquifers regenerate themselves, and consequently the Dead Sea Works in cooperation with Mekor and Tahal (the Israel Water Authorities), are constantly searching for regenerable aquifiers Furthermore water saving is a prime concern in the plant, and prizes are given each year t outstanding workers in this field.
- Channels and dikes have been erected to prevent damage to the plant and its evaporation systems by flash floods. The water held behind the dikes is utilized for the needs of the plant, thus saving millions of cubic meters of water that otherwise need to be pumped from the aquifers.
- The conveyor belt carrying potash from Sodom (400 m below sea level) to the railhead at Mishor Zefa (400 m above sea level) prevents the emission of polluting gases from the tens of thousands of truck rounds that were previously required for this transportation and saves the roads around the plant from congestion.
- The route of this 18 km-long conveyor was planned in detail together with the Israel Nature Reserves Authority, and even shifted in certain places to prevent damage to flora and fauna.

ENERGY AND POTABLE WATER

The refineries require energy mainly in two forms: electricity and steam. Co-generation combines these two, enabling the Dead Sea Works to produce power with 80% efficiency (compared with up to 40% in ordinary power plants). This saves fuel and reduces emissior to the minimum, and is a prerequisite for the production of magnesium metal. At present th power plant in Sodom produces 110 MW of electricity, and plans are underway to enlarge for future development. Since the water pumped from the wells in the area is brackish, wat for human uses are produces by reverse osmosys.

THE LEVEL OF THE DEAD SEA

Over the centuries, the level of the Dead Sea has fluctuated, as observed by various travelers and reported by geographers in the scientific literature. The level is determined b the balance between the incoming streams, i.e., rainfall, the Jordan River and various streams and springs, on the one hand, and evaporation on the other. A series of dry years will cause a drop in the level of the sea, while a series of rainy years will cause it to rise. During the last 30 years the sweet waters of the Jordan River and other streams have bee increasingly utilized by both Israel and Jordan. This has led to an almost uninterrupted dro in the level of the Dead Sea, causing the shallow southern basin to dry up completely. The only water in this basin is that pumped in by the Dead Sea Works in the west and the Arab Potash Company in the east. If not for the evaporation ponds of the Dead Sea Works the hotels at Shefeh Zohar would be left high and dry!

SUMMARY

The industrial complex of the Dead Sea Works is doing the utmost to utilize the minerals of the Dead Sea, while sparing no effort to preserve the unique environment and ecology of this region.

Looking Back (Hebrew) | Time Line (Hebrew)
Industrial Activity (Hebrew) | Industrial Activity (English)